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A Gas Generator for Balloon Inflation

It is hereby proposed that a feasibility study be made to investigate the advantages of producing balloon-inflating gas by means of a hydrazine gas generator.

Letter written to

The use of hydrazine as a gas generant is not new, but its combination with an ammonia thermal-decomposition unit to reduce the temperature of the emitted gas is novel. This type of generator should offer many advantages over those now existing. The gas from hydrazine gas generator should provide greater lift with approximately half the volume of gas that is now required with hot air. This advantage is gained from the relatively low molecular weight of the generated gas and therefore, it should be noted that the lift produced by the gas from the hydrazine generator is not in any manner dependent on an artificial state (elevated temperature) as is the hot air type. The increased lift with reduced volume will also reduce the time needed to inflate the gas bag. The hydrazine generator will produce a controllable flow rate of inflating gas, allowing the choice of the best rate of gas production consistent with the optimum weight of a portable generator and its auxliary apparatus. The usual safety disadvantages of a hydrogen balloon would be considerably reduced because the inflating gas from this unit will contain nitrogen as well as hydrogen, but no oxygen.

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At this time, it is believed that the generator will be basically a two stage unit (Fig. 1) consisting of a glow-plug type hydrazine gas generator and an ammonia decomposition heat exchanger. The first stage would provide gaseous nitrogen and hydrogen at elevated temperatures while the second stage would absorb the heat of these gases and in so doing, produce additional gaseous nitrogen and hydrogen.

These reactions might be written as follows, with the complete hydrazine decomposition represented by two consecutive reactions:

1. $3N_2H_4(l) \rightarrow 4NH_3(g) + N_2(g) + 80.15$ k cal

2. $4NH_3(g) \rightarrow 2N_2(g) + 6H_2(g) - 44.00$ k cal

The ammonia decomposition reaction of the second stage would be identical to equation 2, and so with the proper ratio of hydrazine and ammonia, the temperature of the emitted gases should be close to ambient.

It is therefore proposed that for the sum of \$2,937.45, the following phases be accomplished.

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Phase I

In order that the advantages and disadvantages of the hydrazine type generator might be better understood, it is proposed that a brief "state-of-the-art" survey of other types of gas generators suitable for this end usage be made.

The phase would be a minor part of the program.

Phase II

This phase would consist of theoretical and practical studies of the basic concepts of the hydrazine gas generator. These would include the determination of emission gas temperature, its composition and its compatibility with proposed gas bag material. It would also estimate the total weight of the apparatus, fuel quantities and ratio as well as efficiency or lift per pound of fuel.

Phase III

This phase would include a design study leading to the submission of an experimental portable generator design which should meet specifications.

An estimated cost survey is attached.

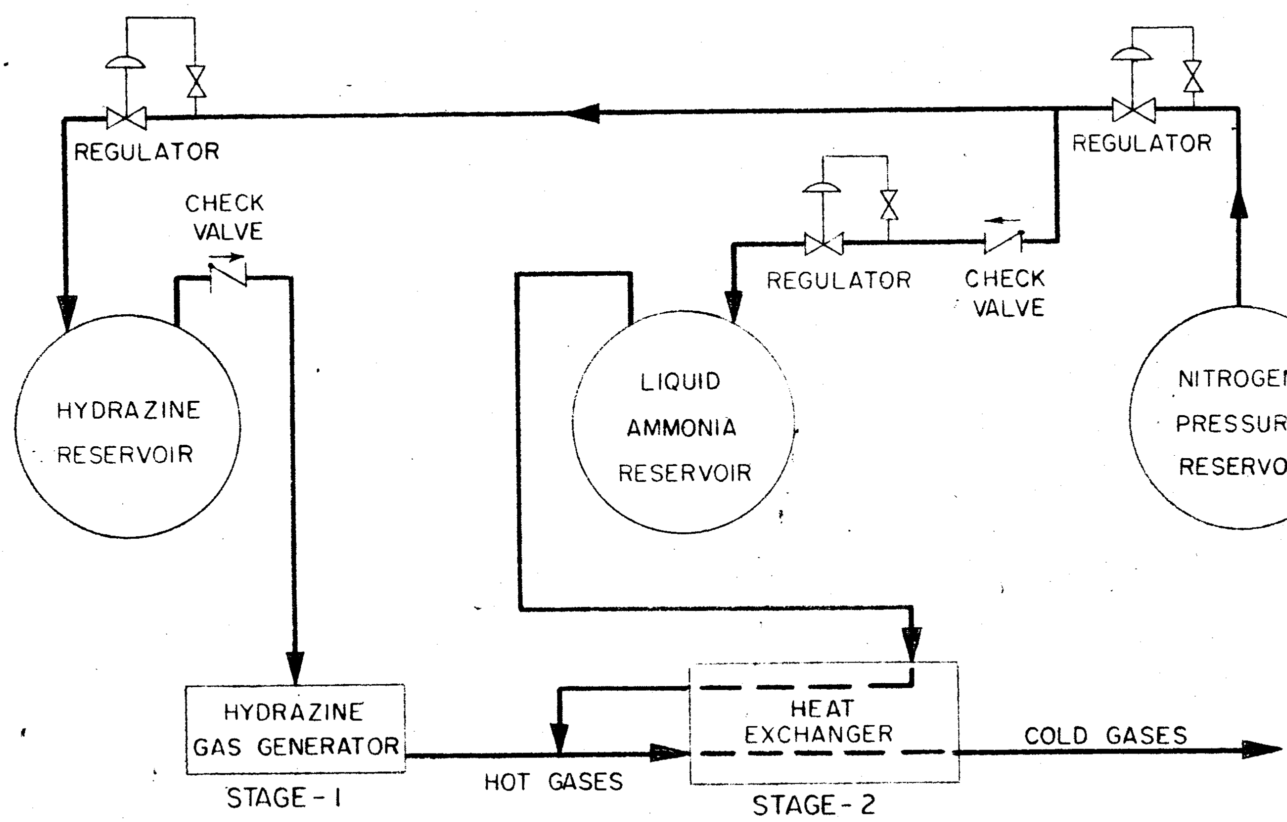

FIGURE - I

HYDRAZINE GAS GENERATOR FLOW DIAGRAM

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